Google Chrome

Google Chrome (commonly known simply as **Chrome**) is a cross-platform web browser developed by Google. It was first released in 2008 for Microsoft Windows, and was later ported to Linux, macOS, iOS, and Android. The browser is also the main component of Chrome OS, where it serves as the platform forweb apps.

Most of Chrome's source code comes from Google's open-source Chromium project, but Chrome is licensed as proprietary freeware.[14] WebKit was the original rendering engine, but Google eventually forked it to create the Blink engine; all Chrome variants except iOS now use Blink.[15]

As of April 2019, StatCounter estimates that Chrome has a 70.05%[16] worldwide browser market share on traditional PCs and 63.16%[17] share across all platforms. Because of this success, Google has expanded the "Chrome" brand name to other products: Chrome OS, Chromecast, Chromebook, Chromebit, Chromebox, and Chromebase.

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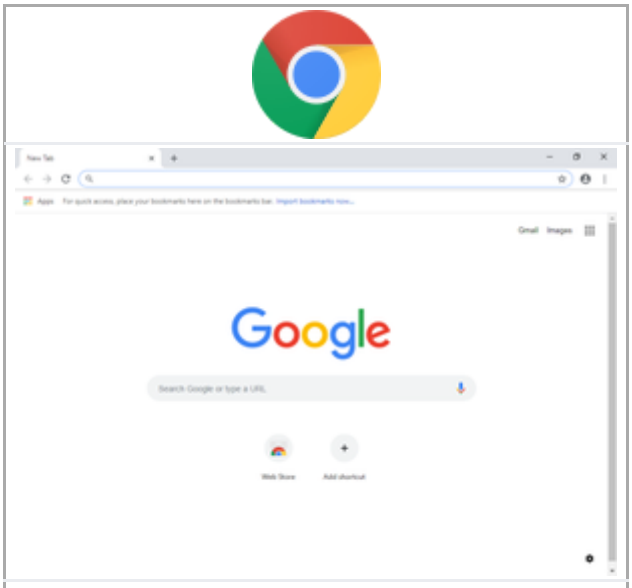
Google Chrome



Developer(s)	Google LLC
Initial release	September 2, 2008
Stable release(s) [±]	
Windows, macOS, Linux	74.0.3729.131 / April 30, 2019[1]
Android	74.0.3729.136 / May 3, 2019[2]
iOS	74.0.3729.121 / April 29, 2019[3]
Preview release(s) [±]	
Beta (Windows, macOS, Linux)	75.0.3770.27 / May 8, 2019[4]
Beta (Android)	75.0.3770.28 / May 8, 2019[5]
Beta (iOS)	75.0.3770.17 / May 2, 2019[6]
Dev (Windows, macOS, Linux)	76.0.3788.1 / May 3, 2019[7]
Dev (Android)	76.0.3786.0 / May 7, 2019[6]
Dev (iOS)	76.0.3787.0 / May 7, 2019[6]
Canary (Windows, macOS)	76.0.3793.0 / May 13, 2019[6]
Canary (Android)	76.0.3793.0 / May 13,

Release channels, cycles and updates
Release version numbers
Color management
T-Rex
Platforms
Compatibility
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	2019[6]
Development status	Active
Written in	C, C++, Java (Android app only), JavaScript, Python[8][9][10]
Operating system	Android KitKat and later[11] Chrome OS iOS 11 or later[12] Linux macOS 10.10 or later Windows 7 or later
Included with	Android Jelly Bean or later Chrome OS
Engines	Blink (WebKit on iOS), V8
Platform	IA-32, x86-64, ARMv7, ARMv8-A
Available in	47 languages[13]
Type	Web browser, mobile browser
License	Proprietary freeware, based on open source components.[14][note 1]
Website	www.google.com /chrome/

History

Google CEO Eric Schmidt opposed the development of an independent web browser for six years. He stated that "at the time, Google was a small company", and he did not want to go through "bruising browser wars". After co-founders Sergey Brin and Larry Page hired several Mozilla Firefox developers and built a demonstration of Chrome, Schmidt admitted that "It was so good that it essentially forced me to change my mind."[18]

In September 2004, rumors of Google building a web browser first appeared. Online journals and U.S. newspapers stated at the time that Google was hiring former Microsoft web developers among others. It also came shortly after the final 1.0 release of Mozilla Firefox, which was surging in popularity and taking market share from Internet Explorer, which was suffering from major security problems.[19]

Announcement

The release announcement was originally scheduled for September 3, 2008, and a comic by Scott McCloud was to be sent to journalists and bloggers explaining the features within the new browser.[20] Copies intended for Europe were shipped early and German blogger Philipp Lenssen of Google Blogoscoped[21] made a scanned copy of the 38-page comic available on his website after receiving it on September 1, 2008.[22] Google subsequently made the comic available on Google Books[23] and mentioned it on their official blog along with an explanation for the early release.[24] The product was allegedly named "Chrome" because Google wanted to minimize the chrome of the browser,[25] though this meaning was added somewhat post-hoc, the code name before release apparently chosen from a connotation of speed.[26]

Public release

The browser was first publicly released on September 2, 2008 for Windows XP and later, with 43 supported languages, officially a beta version,[27] and as a stable public release on December 11, 2008.

On the same day, a CNET news item[28] drew attention to a passage in the Terms of Service statement for the initial beta release, which seemed to grant to Google a license to all content transferred via the Chrome browser. This passage was inherited from the general Google terms of service.[29] Google responded to this criticism immediately by stating that the language used was borrowed from other products, and removed this passage from the Terms of Service.[14]

An early version of Chromium for Linux, explaining the difference between Chrome and Chromium

Chrome quickly gained about 1% usage share.[24][30][31] After the initial surge, usage share dropped until it hit a low of 0.69% in October 2008. It then started rising again and by December 2008, Chrome again passed the 1% threshold.[32]

In early January 2009, CNET reported that Google planned to release versions of Chrome for OS X and Linux in the first half of the year.[33] The first official Chrome OS X and Linux developer previews[34] were announced on June 4, 2009, with a blog post[35] saying they were missing many features and were intended for early feedback rather than general use.

In December 2009, Google released beta versions of Chrome for OS X and Linux.[36][37] Google Chrome 5.0, announced on May 25, 2010, was the first stable release to support all three platforms.[38]

Chrome was one of the twelve browsers offered to European Economic Area users of Microsoft Windows in 2010.[39]

Development

Chrome was assembled from 25 different code libraries from Google and third parties such as Mozilla's Netscape Portable Runtime, Network Security Services, NPAPI (dropped as of version 45),[40] Skia Graphics Engine, SQLite, and a number of other open-source projects.[41] The V8 JavaScript virtual machine was considered a sufficiently important project to be split off (as was Adobe/Mozilla's Tamarin) and handled by a separate team in Denmark coordinated by Lars Bak in Aarhus. According to Google, existing implementations were designed "for small programs, where the performance and interactivity of the system weren't that important", but web applications such as Gmail "are using the web browser to the fullest when it comes to DOM manipulations and JavaScript", and therefore would significantly benefit from a JavaScript engine that could work faster.

Chrome initially used the WebKit rendering engine to display web pages. In 2013, they forked the WebCore component to create their own layout engine Blink. Based on WebKit, Blink only uses WebKit's "WebCore" components, while substituting other components, such as its own multi-process architecture, in place of WebKit's native implementation.[15]

Chrome is internally tested with unit testing, "automated user interface testing of scripted user actions", fuzz testing, as well as WebKit's layout tests (99% of which Chrome is claimed to have passed), and against commonly accessed websites inside the Google index within 20–30 minutes.[23]

Google created Gears for Chrome, which added features for web developers typically relating to the building of web applications, including offline support.[23] Google phased out Gears as the same functionality became available in the HTML5 standards.[42]

On January 11, 2011, the Chrome product manager, Mike Jazayeri, announced that Chrome would remove H.264 video codec support for its HTML5 player, citing the desire to bring Google Chrome more in line with the currently available open codecs available in the Chromium project, which Chrome is based on.[43] Despite this, on November 6, 2012, Google released a version of Chrome on Windows which added hardware-accelerated H.264 video decoding.[44] In October 2013, Cisco announced that it was open-sourcing its H.264 codecs and will cover all fees required.[45]

On February 7, 2012, Google launched *Google Chrome Beta* for Android 4.0 devices.[46] On many new devices with Android 4.1 and later preinstalled, Chrome is the default browser.[47]

In May 2017, Google announced a version of Chrome for augmented reality and virtual reality devices.[48]

Version history

Features

Google Chrome features a minimalistic user interface, with its user-interface principles later being implemented into other browsers. For example, the merging of the address bar and search bar into the *omnibox*.[49] Chrome also has a reputation for strong browser performance.[50][51]

Bookmarks and settings synchronization

Chrome allows users to synchronize their bookmarks, history, and settings across all devices with the browser installed by sending and receiving data through a chosen Google Account, which in turn updates all signed-in instances of Chrome. This can be authenticated either through Google credentials, or a sync passphrase.

Web standards support

The first release of Google Chrome passed both the Acid1 and Acid2 tests. Beginning with version 4.0, Chrome has passed all aspects of the Acid3 test.[52]

The results of the Acid3 test on Google Chrome 4.0

As of May 2011, Chrome has very good support for JavaScript/ECMAScript according to Ecma International's ECMAScript standards conformance Test 262[53] (version ES5.1 May 18, 2012). This test reports as the final score the number of tests a browser failed; hence lower scores are better. In this test, Chrome version 37 scored 10 failed/11578 passed. For comparison, Firefox 19 scored 193 failed/11752 passed and Internet Explorer 9 has a score of 600+ failed, while Internet Explorer 10 has a score of 7 failed.

In 2011, on the official CSS 2.1 test suite by standardization organization W3C, WebKit, the Chrome rendering engine, passes 89.75% (89.38% out of 99.59% covered) CSS 2.1 tests.[54]

On the HTML5 web standards test, Chrome 41 scores 518 out of 555 points, placing it ahead of the five most popular desktop browsers.[55][56] Chrome 41 on Android scores 510 out of 555 points.[57][58][59] Chrome 44 scores 526, only 29 points less than the maximum score.[60]

Security

Chrome periodically retrieves updates of two blacklists (one for phishing and one for malware), and warns users when they attempt to visit a site flagged as potentially harmful. This service is also made available for use by others via a free public API called "Google Safe Browsing API".[23]

Chrome uses a process-allocation model to sandbox tabs.[61] Using the principle of least privilege, each tab process cannot interact with critical memory functions (e.g. OS memory, user files) or other tab processes – similar to Microsoft's "Protected Mode" used by Internet Explorer 9 or greater. The *Sandbox Team* is said to have "taken this existing process boundary and made it into a jail". This enforces a computer security model whereby there are two levels of multilevel security (*user* and *sandbox*) and the *sandbox* can only respond to communication requests initiated by the *user*.[62] On Linux sandboxing uses the seccomp mode.[63][64]

Since 2008, Chrome has been faulted for not including a master password to prevent casual access to a user's passwords. Chrome developers have indicated that a master password does not provide real security against determined hackers and have refused to implement one. Bugs filed on this issue have been marked "WontFix".[65][66] As of February 2014, the Windows version asks the

user to enter the Windows account password before showing saved passwords.[67]

In January 2015, TorrentFreak reported that using Chrome when connected to the internet using a VPN can be a serious security issue due to the browser's support for WebRTC.[68]

On September 9, 2016, it was reported that starting with Chrome 56, users will be warned when they visit insecure HTTP websites to encourage more sites to make the transition to HTTPS.[69]

On December 4, 2018, Google announced its Chrome 71 release with new security features, including a built-in ad featuring system. In addition, Google also announced its plan to crack down websites that make people involuntarily subscribe to mobile subscription plans.[70]

Security vulnerabilities

No security vulnerabilities in Chrome were exploited in the three years of Pwn2Own from 2009–2011.[71]

At Pwn2Own 2012, Chrome was defeated by a French team who used zero day exploits in the version of Flash shipped with Chrome to take complete control of a fully patched 64-bit Windows 7 PC using a booby-trapped website that overcame Chrome's sandboxing.[72]

Chrome was compromised twice at the 2012 CanSecWest Pwnium.[72][73][74] Google's official response to the exploits was delivered by Jason Kersey, who congratulated the researchers, noting "We also believe that both submissions are works of art and deserve wider sharing and recognition."[75] Fixes for these vulnerabilities were deployed within 10 hours of the submission.[76][77]

A significant number of security vulnerabilities in Chrome occur in the Adobe Flash Player. For example, the 2016 Pwn2Own successful attack on Chrome relied on four security vulnerabilities. Two of the vulnerabilities were in Flash, one was in Chrome, and one was in the Windows kernel.[78] In 2016, Google announced that it was planning to phase out Flash Player in Chrome, starting in version 53. The first phase of the plan is to disable Flash for ads and "background analytics", with the ultimate goal of disabling it completely by the end of the year, except on specific sites that Google has deemed to be broken without it. Flash would then be re-enabled with the exclusion of ads and background analytics on a site-by-site basis.[79]

Leaked documents published by WikiLeaks, codenamed Vault 7 and dated from 2013–2016, detail the capabilities of the CIA, such as the ability to compromise web browsers (including Google Chrome).[80][81]

Malware blocking and ad blocking

Google introduced download scanning protection in Chrome 17.[82] In February 2018, Google introduced an ad blocking feature based on recommendations from the Interactive Advertising Bureau. Sites that employ invasive ads are given a 30-day warning, after which their ads will be blocked.[83] *Consumer Reports* recommended users install dedicated ad-blocking tools instead, which offer increased security against malware and tracking.[84]

Plugins

- Chrome supported, up to version 45, plug-ins with the Netscape Plugin Application Programming Interface (NPAPI),[85] so that plug-ins (for example Adobe Flash Player) run as unrestricted separate processes outside the browser and cannot be sandboxed as tabs are. ActiveX is not supported.[85] Since 2010, Adobe Flash has been integral to Chrome and does not need be installed separately. Flash is kept up to date as part of Chrome's own updates.[86] Java applet support was available in Chrome with Java 6 update 12 and above.[87] Support for Java under OS X was provided by a Java Update released on May 18, 2010.[88]
- On August 12, 2009, Google introduced a replacement for NPAPI that is more portable and more secure[89] called Pepper Plugin API (PPAPI).[90] The default bundled PPAPI Flash Player (or Pepper-based Flash Player) was available on Chrome OS first, then replaced the NPAPI Flash Player on Linux from Chrome version 20, on Windows from version 21 (which also reduced Flash crashes by 20%),[91] and eventually came to OS X at version 23.[92]
- On September 23, 2013, Google announced that it will be deprecating and then removing NPAPI support. NPAPI support was removed from Linux in Chrome release 35.[93] NPAPI plugins like Java can no longer work in Chrome

(but there are workarounds for Flash by using PPAPI Flash Player on Linux including for Chromium).[94]

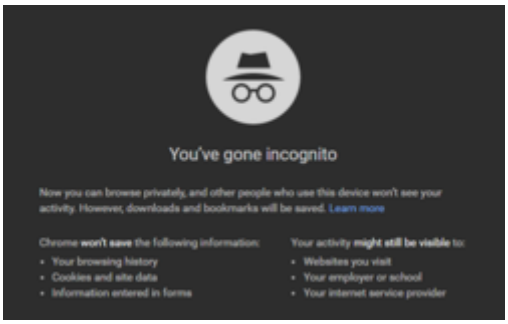
- On April 14, 2015, Google released Chrome v42, disabling the NPAPI by default. This makes plugins that do not have a PPAPI plugin counterpart incompatible with Chrome, such as Java, Silverlight and Unity. However, NPAPI support could be enabled through the chrome://flags menu, until the release of version 45 in September 2015, that removed NPAPI support entirely.[95]

Privacy

Incognito mode

The private browsing feature called *Incognito* mode prevents the browser from permanently storing any history information, cookies, site data, or form inputs.[96] Downloaded files and bookmarks will be stored. In addition, user activity is not hidden from visited websites or the Internet service provider

Incognito mode is similar to the private browsing feature in other web browsers. It doesn't prevent saving in all windows: "You can switch between an incognito window and any regular windows you have open. You'll only be in incognito mode when you're using the incognito window".[97]


You've gone incognito
Now you can browse privately, and other people who use this device won't see your activity. However, downloads and bookmarks will be saved. Learn more
Chrome won't save the following information:
• Your browsing history
• Cookies and site data
• Information entered in forms
Your activity might still be visible to:
• Websites you visit
• Your employer or school
• Your internet service provider
Google Chrome Incognito mode message

Listening capabilities

In June 2015, the Debian developer community discovered that Chromium 43 and Chrome 43 were programmed to download the *Hotword Shared Module*, which could enable the OK Google voice recognition extension, although by default it was "off". This raised privacy concerns in the media.[98][99] The module was removed in Chrome 45, which was released on September 1, 2015, and was only present in Chrome 43 and 44.[100][101]

User tracking concerns

Chrome sends details about its users and their activities to Google through both optional and non-optional user tracking mechanisms.[102][103]

Some of the tracking mechanisms can be optionally enabled and disabled through the installation interface[104] and through the browser's options dialog.[105] Unofficial builds, such as SRWare Iron, seek to remove these features from the browser altogether.[106] The RLZ feature is not included in the Chromium browser either.[107]

In March 2010, Google devised a new method to collect installation statistics: the unique ID token included with Chrome is now used for only the first connection that Google Update makes to its server.[108]

The optional suggestion service included in Google Chrome has been criticized because it provides the information typed into the Omnibox to the search provider before the user even hits return. This allows the search engine to provide URL suggestions, but also provides them with web use information tied to an IP address.[109]

The optional feature to use a web service to help resolve spelling errors has privacy implications.[110]

Tracking methods

Method[106]	Information sent	When	Optional?	Opt-in?
Installation	Randomly generated token included in installer; used to measure success rate of Google Chrome once at installation[111]	On installation	No	N/A
RLZ identifier[112]	Encoded string, according to Google, contains non-identifying information on where Chrome was downloaded from and its installation week; is used to measure promotional campaigns;[111] Google provides source code to decode this string[107] Can be disabled in Chrome Operating System.[111] For Chrome browsers running in all other operating systems:[111] ▪ Desktops can avoid it by downloading the browser directly from Google.com/chrome. ▪ Phones, tablets, maybe laptops: Google has not said that it can be disabled	▪ On Google search query ▪ On first launch and first use of address bar[111]	Partial [note 2][111]	No
clientID[105]	Unique identifier along with user preferences, logs of use metrics and crashes	Unknown	Yes[113]	Yes
Omnibox predictions[105]	Text typed into the address bar	While typing	Yes	No
Page not found	Text typed into the address bar	On receiving "Server not found" response	Yes	No
Google Update	Information about how often Chrome is used, details about the OS and Chrome version	Periodically	Partial [note 3][114]	No

Do Not Track

In February 2012, Google announced that Chrome would implement the Do Not Track (DNT) standard to inform websites the user's desire to be not tracked. The protocol was implemented in version 23. In line with the W3's draft standard for DNT,[115] it is turned off by default in Chrome.[116]

Speed

The JavaScript virtual machine used by Chrome, the V8 JavaScript engine, has features such as *dynamic code generation*, *hidden class transitions*, and *precise garbage collection*.[23]

In 2008, several websites performed benchmark tests using the SunSpider JavaScript Benchmark tool as well as Google's own set of computationally intense benchmarks, which include ray tracing and constraint solving.[117] They unanimously reported that Chrome performed much faster than all competitors against which it had been tested, including Safari (for Windows), Firefox 3.0, Internet Explorer 7, Opera, and Internet Explorer 8.[118][119][120][50][121][122] However, on October 11, 2010, independent tests of JavaScript performance, Chrome has been scoring just behind Opera's Presto engine since it was updated in version 10.5.[123]

On September 3, 2008, Mozilla responded by stating that their own TraceMonkey JavaScript engine (then in beta), was faster than Chrome's V8 engine in some tests.[124][125][126] John Resig, Mozilla's JavaScript evangelist, further commented on the performance of different browsers on Google's own suite, commenting on Chrome's "decimating" of the other browsers, but he questioned whether Google's suite was representative of real programs. He stated that Firefox 3.0 performed poorly on recursion-intensive benchmarks, such as those of Google, because the Mozilla team had not implemented recursion-tracing yet.[127]

Two weeks after Chrome's launch in 2008, the WebKit team announced a new JavaScript engine, SquirrelFish Extreme,[128] citing a 36% speed improvement over Chrome's V8 engine.[129][130][131]

Like most major web browsers, Chrome uses DNS prefetching to speed up website lookups,[132] as do other browsers like Firefox,[133] Safari,[134] Internet Explorer (called DNS Pre-resolution),[135] and in Opera as a UserScript (not built-in).[136]

Chrome formerly used their now deprecated SPDY protocol instead of only HTTP[137][138] when communicating with servers that support it, such as Google services, Facebook, Twitter. SPDY support was removed in Chrome version 51.

Stability

A multi-process architecture is implemented in Chrome[139] where, by default, a separate process is allocated to each site instance and plugin. This procedure is termed process isolation,[140] and it prevents tasks from interfering with each other, raising security and stability. An attacker successfully gaining access to one application gains access to no others,[141] and failure in one instance results in a *Sad Tab* screen of death, similar to the well-known *Sad Mac*, but only one tab crashes instead of the whole application. This strategy exacts a fixed per-process cost up front, but results in less memory bloat over time as fragmentation is confined to each instance and no longer needs further memory allocations.[23] This architecture was adopted in Safari[142] and Firefox.[143]

Screenshot of Chrome browser crash

Chrome includes a process management utility called *Task Manager* which lets users see what sites and plugins are using the most memory, downloading the most bytes and overusing the CPU and provides the ability to terminate them.[23] Chrome Version 23 ensures its users an improved battery life for the systems supporting Chrome's GPU accelerated video decoding.[144][44]

User interface

By default, the main user interface includes back, forward, refresh/cancel and menu buttons. A home button is not shown by default, but can be added through the Settings page to take the user to the new tab page or a custom home page.[145]

Tabs are the main component of Chrome's user interface and have been moved to the top of the window rather than below the controls. This subtle change contrasts with many existing tabbed browsers which are based on windows and contain tabs. Tabs, with their state, can be transferred seamlessly between window containers by dragging. Each tab has its own set of controls, including the *Omnibox*.[23]

The *Omnibox* is a URL box that combines the functions of both the address bar and search box. If a user enters the URL of a site previously searched from, Chrome allows pressing *Tab* to search the site again directly from the Omnibox. When a user starts typing in the Omnibox, Chrome provides suggestions for previously visited sites (based on the URL or in-page text), popular websites (not necessarily visited before – powered by Google Instant), and popular searches. Although Instant can be turned off, suggestions based on previously visited sites cannot be turned off. Chrome will also autocomplete the URLs of sites visited often.[23] If a user types keywords into the Omnibox that don't match any previously visited websites and presses enter, Chrome will conduct the search using the default search engine.

One of Chrome's differentiating features is the *New Tab Page*, which can replace the browser home page and is displayed when a new tab is created. Originally, this showed thumbnails of the nine most visited web sites, along with frequent searches, recent bookmarks, and recently closed tabs; similar to Internet Explorer and Firefox with Google Toolbar, or Opera's Speed Dial.[23] In Google Chrome 2.0, the New Tab Page was updated to allow users to hide thumbnails they did not want to appear.[146]

Starting in version 3.0, the New Tab Page was revamped to display thumbnails of the eight most visited web sites. The thumbnails could be rearranged, pinned, and removed. Alternatively, a list of text links could be displayed instead of thumbnails. It also features a "Recently closed" bar that shows recently closed tabs and a "tips" section that displays hints and tricks for using the browser.[147]

Chrome includes a *bookmarks* submenu that lists the user's bookmarks, provides easy access to Chrome's *Bookmark Manager*, and allows the user to toggle a *bookmarks bar* on or off.

For web developers, Chrome features an element inspector (Inspect Element), similar to the Firebug browser extension, which allows users to look into the DOM and see what makes up the webpage.[132]

Chrome has special URLs that load application-specific pages instead of websites or files on disk. Chrome also has a built-in ability to enable experimental features. Originally called `about:labs`, the address was changed to `about:flags` to make it less obvious to casual users.[148][149]

In March 2011, Google introduced a new simplified logo to replace the previous 3D logo that had been used since the project's inception. Google designer Steve Rura explained the company reasoning for the change: "Since Chrome is all about making your web experience as easy and clutter-free as possible, we refreshed the Chrome icon to better represent these sentiments. A simpler icon embodies the Chrome spirit – to make the web quicker, lighter, and easier for all."[150]

In September 2013, Google started making Chrome apps "For your desktop". This meant offline access, desktop shortcuts, and less dependence on Chrome—apps launch in a window separate from Chrome, and look more like native applications.[151]

On January 2, 2019, Google introduced Native Dark Theme for Chrome on Windows 10.[152]

Google Chrome logos

3D motif from first public release September 2008 until March 2011

2D motif from March 2011 until October 2015

Material Design motif used from September 2014 onward for mobile version and October 2015 onward for desktop version

Desktop shortcuts and apps

Chrome allows users to make local desktop shortcuts that open web applications in the browser. The browser, when opened in this way, contains none of the regular interface except for the title bar, so as not to "interrupt anything the user is trying to do". This allows web applications to run alongside local software (similar to Mozilla Prism and Fluid).[23]

This feature, according to Google, will be enhanced with the Chrome Web Store, a one-stop web-based web applications directory which opened in December 2010.[153][154]

Chrome Web Store

Announced on December 7, 2010, the Chrome Web Store allows users to install web applications as extensions to the browser, although most of these extensions function simply as links to popular web pages and/or games, but some of the apps like Springpad do provide extra features like offline access. The themes and extensions have also been tightly integrated into the new store, allowing users to search the entire catalog of Chrome extras.[155]

The Chrome Web Store was opened on February 11, 2011, with the release of Google Chrome 9.0.[156]

Extensions

Google Chrome Extensions are browser extensions that modify Google Chrome.[157] These extensions are written using web technologies like HTML, JavaScript, and CSS.[158] They are distributed through Chrome Web Store[159] (which was originally called the Google Chrome Extensions Gallery).[157] All users with a Google Account are able to add extensions after developing them.[160] Many Chrome extensions, once installed, have access to the user's data. There are three levels of permissions that an app or extension may request.[161]

On September 9, 2009, Google enabled extensions by default on Chrome's developer channel, and provided several sample extensions for testing.[162] In December, the Google Chrome Extensions Gallery beta began with approximately 300 extensions.[37][163] It was launched on January 25, 2010 along with Google Chrome 4.0, containing approximately 1500 extensions.[164]

In 2014, Google started preventing some Windows users from installing extensions not hosted on the Chrome Web Store.[165][166] The following year Google reported a "75% drop in customer support help requests for uninstalling unwanted extensions" which led them to expand this restriction to all Windows and Mac users.[167]

Notable examples

- Adblock Plus[168]
- Adblock for Chrome
- Cut the Rope
- Dropbox
- Evernote Web
- Facebook Messenger[169]
- Ghostery
- Googlepedia
- Google Maps
- HTTPS Everywhere
- Pandora Radio
- Pixlr Express
- Privacy Badger
- Streamus (discontinued)
- Turn Off the Lights
- TweetDeck
- Stop Tony Meow
- uBlock Origin[170]

Themes

Starting with Google Chrome 3.0, users can install themes to alter the appearance of the browser.[171] Many free third-party themes are provided in an online gallery[172] accessible through a "Get themes" button in Chrome's options.[173]

Automatic web page translation

Starting with Google Chrome 4.1 the application added a built-in translation bar using Google Translate. Translation is currently available for 52 languages.[174] When Chrome detects a foreign language other than the user's preferred language as set during the installation time, it asks the user whether or not to translate.

Release channels, cycles and updates

The first production release on December 11, 2008, marked the end of the initial Beta test period and the beginning of Production. Shortly thereafter, on January 8, 2009, Google announced an updated release system with three channels: Stable (corresponding to the traditional Production), Beta, and Developer preview (also called the "Dev" channel). Where there were before only two channels: Beta and Developer, now there were three. Concurrently, all Developer channel users were moved to the Beta channel along with the promoted Developer release. Google explained that now the Developer channel builds would be less stable and polished than those from the initial Google Chrome's Beta period. Beta users could opt back to the Developer channel as desired.

Each channel has its own release cycle and stability level. The Stable channel updated roughly quarterly, with features and fixes that passed "thorough" testing in the Beta channel. Beta updated roughly monthly, with "stable and complete" features migrated from the Developer channel. The Developer channel updated once or twice per week and was where ideas and features were first publicly exposed "(and sometimes fail) and can be very unstable at times". [Quoted remarks from Google's policy announcements.][175][176][177]

On July 22, 2010, Google announced it would ramp up the speed at which it releases new stable versions; the release cycles were shortened from quarterly to six weeks for major Stable updates.[178] Beta channel releases now come roughly at the same rate as Stable releases, though approximately one month in advance, while Dev channel releases appear roughly once or twice weekly, allowing time for basic release-critical testing.[179] This faster release cycle also brought a fourth channel: the "Canary" channel, updated daily from a build produced at 09:00 UTC from the most stable of the last 40 revisions.[180] The name refers to the practice

of using canaries in coal mines, so if a change "kills" Chrome Canary, it will be blocked from migrating down to the Developer channel, at least until fixed in a subsequent Canary build.[181] Canary is "the most bleeding-edge official version of Chrome and somewhat of a mix between Chrome dev and the Chromium snapshot builds". Canary releases run side-by-side with any other channel; it is not linked to the other Google Chrome installation and can therefore run different synchronization profiles, themes, and browser preferences. This ensures that fallback functionality remains even when some Canary update may contain release-breaking bugs.[182] It does not natively include the option to be the default browser, although on Windows and OS X it can be set through System Preferences. Canary was Windows-only at first; an OS X version was released on May 3, 2011.[183]

Google Chrome Canary Application Icon

The Chrome beta channel for Android was launched on January 10, 2013; like Canary, it runs side-by-side with the stable channel for Android.[184][185] Chrome Dev for Android was launched on April 29, 2015.[186]

All Chrome channels are automatically distributed according to their respective release cycles. The mechanism differs by platform. On Windows, it uses Google Update, and auto-update can be controlled via Group Policy.[187] Alternatively, users may download a standalone installer of a version of Chrome that does not auto-update.[188][189] On OS X, it uses Google Update Service, and auto-update can be controlled via the OS X "defaults" system.[190] On Linux, it lets the system's normal package management system supply the updates. This auto-updating behavior is a key difference from Chromium, the non-branded open-source browser which forms the core of Google Chrome. Because Chromium also serves as the pre-release development trunk for Chrome, its revisions are provided as source code and buildable snapshots are produced continuously with each new commit, requiring users to manage their own browser updates.[191]

Release version numbers

Releases are identified by a four-part version number, e.g. 42.0.2311.90 (Windows Stable release April 14, 2015[192]). The components are major.minor.build.patch.[193][194]

> *Major.minor* reflects scheduling policy
> *Build.patch* identifies content progression

- *Major* represents a product release. These are scheduled 7–8 per year, unlike other software systems where the *major* version number updates only with substantial new content.
- *Minor* is usually 0. References to version 'x' or 'x.0', e.g. 42.0, refer to this *major.minor* designation.
- *Build* is ever increasing. For a release cycle, e.g. 42.0, there are several builds in the Canary and Developer period. The last *build* number from Developer is kept throughout Beta and Stable and is locked with the *major.minor* for that release.
- *Patch* resets with each *build*, incrementing with each *patch*. The first *patch* is 0, but usually the first publicly released *patch* is somewhat higher. In Beta and Stable, only *patch* increments.

Chromium and Chrome release schedules are linked through Chromium (*Major*) version Branch Point dates, published annually.[193] The Branch Points precede the final Chrome Developer build (initial) release by 4 days (nearly always) and the Chrome Stable initial release by roughly 53 days.[195]

Example: The version 42 Branch Point was February 20, 2015.[193] Developer builds stopped advancing at *build* 2311 with release 42.0.2311.4 on February 24,[196] 4 days later. The first Stable release, 42.0.2311.90, was April 14, 2015,[192] 53 days after the Branch Point.

Color management

Chrome supports color management by using the system-provided ICC v2 and v4 support on macOS, and from version 22 supports ICC v2 profiles by default on other platforms.[197]

T-Rex

In Chrome, when not connected to the Internet and an error message displaying "There is no Internet" is shown, on the top, an "8-bit" *Tyrannosaurus rex* is shown, but when pressing the space bar on a keyboard, mouse-clicking on it or tapping it on touch devices, the T-Rex instantly jumps once and dashes across a cactus-ridden desert, revealing it to be an Easter egg in the form of a platform game.[198][199][200][201] The game itself is an infinite runner, and there is no time limit in the game as it progresses faster and periodically tints to a black background. A school Chromebook administrator can disable the game.[202]

Platforms

Chrome runs on:

- Windows 7 or later[203]
- OS X 10.10 or later[203]
- 64-bit versions of Ubuntu 14.04+, Debian 8+, openSUSE 13.3+ and Fedora 24+[203]
- Android 4.4 or later
- iOS 11 or later

As of April 2016, stable 32-bit and 64-bit builds are available for Windows, with only 64-bit stable builds available for Linux and macOS.[204][205][206] 64-bit Windows builds became available in the developer channel and as canary builds on June 3, 2014,[207] in beta channel on July 30, 2014,[208] and in stable channel on August 26, 2014.[209] 64-bit OS X builds became available as canary builds on November 7, 2013,[210][211] in beta channel on October 9, 2014,[212] and in stable channel on November 18, 2014.[204]

Compatibility

Operating system		Latest version	Support status
Windows	7 and later	74	2009–
	XP and Vista	49	2008–2016
macOS	10.10 and later	74	2014–
	10.9	65	2013–2018
	10.6–10.8 (x64)	49	2010–2016
	10.6 (IA-32)	38	2010–2014
	10.5 (IA-32,x64)	21	2010–2012
Linux desktop	x64	74	2010–
	IA-32	48	2010–2016
Android	4.4 and later	74	2013–
	4.1-4.3	71[213]	2012–2019
	4.0	42	2012–2015
iOS	11.0 and later	74	2017–
	10.x	72	2016–2019
	9.x , 8.x	63	2014–2018
	7.x	54	2013-2016
	6.x	42	2012-2015
	5.x	30 (For at least 512 MB of RAM) 23 (For 256 MB of RAM)	2012-2013
	4.x	23	2012

Android

A beta version for Android 4.0 devices was launched on February 7, 2012, available for a limited number of countries from Google Play.[214]

Notable features: synchronization with desktop Chrome to provide the same bookmarks and view the same browser tabs,[215] page pre-rendering,[216] hardware acceleration.[217]

Many of the latest HTML5 features: almost all of the Web Platform's features: GPU-accelerated canvas, including CSS 3D Transforms, CSS animations, SVG, WebSocket (including binary messages), Dedicated Workers; it has overflow scroll support, strong HTML5 video support, and new capabilities such as IndexedDB, Web Workers, Application Cache and the File APIs, date- and time-pickers, parts of the Media Capture API.[216][218] Also supports mobile oriented features such as Device Orientation and Geolocation.[218]

Mobile customizations: swipe gesture tab switching,[215] link preview allows zooming in on (multiple) links to ensure the desired one is clicked,[215] font size boosting to ensure readability regardless of the zoom level.[218]

Features missing in the mobile version include sandboxed tabs,[216][219] Safe Browsing,[216] apps or extensions,[217] Adobe Flash (now and in future),[217] Native Client.[217]

Development changes: remote debugging,[216][220] part of the browser layer has been implemented in Java, communicating with the rest of the Chromium and WebKit code through Java Native Bindings.[218] The code of Chrome for Android is a fork of the Chromium project. It is a priority to upstream most new and modified code to Chromium and WebKit to resolve the fork.[218]

The April 17, 2012 update included availability in 31 additional languages and in all countries where Google Play is available. A desktop version of a website can also be requested as opposed to a mobile version. In addition, Android users can now add bookmarks to their Android home screens if they choose and decide which apps should handle links opened in Chrome.[221]

On June 27, 2012, Google Chrome for Android exited beta and became stable.[222]

Chrome 18.0.1026311, released on September 26, 2012, was the first version of Chrome for Android to support mobile devices based on Intel x86.[223]

Starting from version 25, the Chrome version for Android is aligned with the desktop version, and usually new stable releases are available at the same time between the Android and the desktop version. Google released a separate Chrome for Android beta channel on January 10, 2013, with version 25.[184] As of 2013 a separate beta version of Chrome is available in the Google Play store – it can run side-by-side with the stable release.[224]

Chrome OS

Google Chrome is the basis of Google's Chrome OS operating system that ships on specific hardware from Google's manufacturing partners.[225] The user interface has a minimalist design resembling the Google Chrome browser. Chrome OS is aimed at users who spend most of their computer time on the Web; the only applications on the devices are a browser incorporating a media player and a file manager.[226][227][228][229][230]

Google announced Chrome OS on July 7, 2009.[231]

iOS

Chrome is available on Apple's mobile iOS operating system as *Google Chrome for iOS*. Released in the Apple App Store on June 26, 2012, it supports the iPad, iPhone, and iPod touch, and requires that the device has iOS 11.0 or greater installed.[232] In accordance with Apple's requirements for browsers released through their App Store, this version of Chrome uses the *iOS WebKit* – which is Apple's own mobile rendering engine and components, developed for their *Safari* browser – therefore it is restricted from using Google's own V8 JavaScript engine.[233][234] Chrome is the default web browser for the iOS *Gmail* application, but it cannot be used as the device-wide default application for opening webpages because Apple has not provided iOS users with the option to change the default from Safari.[235]

In a review by Chitika, Chrome was noted as having 1.5% of the iOS web browser market as of July 18, 2012.[236] In October 2013, Chrome had 3% of the iOS browser market.[237]

Linux

On Linux distributions, support for 32-bit Intel processors ended in March 2016 although Chromium is still supported.[238] As of Chrome version 26, Linux installations of the browser may be updated only on systems that support GCC v4.6 and GTK v2.24 or later. Thus deprecated systems include (for example) Debian 6's 2.20, and RHEL 6's 2.18.[239]

Windows

Support for Google Chrome on Windows XP and Windows Vista ended in April 2016.[240] The last release of Google Chrome that can be run on Windows XP and Windows Vista was version 49.0.2623.112,[241] released on April 7, 2016,[242] then re-released on April 11, 2016.[243]

"Windows 8 mode" was introduced in 2012 and has since been discontinued. It was provided to developer channel, which enabled Windows 8 and 8.1 users to run Chrome with a full-screen, tablet-optimized interface, with access to snapping, sharing, and search functionalities.[244] In October 2013, Windows 8 mode on developer channel changed to use a desktop environment mimicking the interface of Chrome OS with a dedicated windowing system and taskbar for web apps.[245] This was discontinued as of version 49 and users that have upgraded to Windows 10 will lose this feature.[246]

macOS

Google dropped support for Mac OS X 10.5 with the release of Chrome 22.[247] Support for 32-bit versions of Chrome ended in October 2014 with the release of Chrome 39.[248][249][204] Support for Mac OS X 10.6, 10.7, and 10.8 ended in April 2016 with the release of Chrome 50. Support for OS X 10.9 ended in April 2018 with the release of Chrome 66.

Reception

Google Chrome was met with acclaim upon release. In 2008, Matthew Moore of *The Daily Telegraph* summarized the verdict of early reviewers: "Google Chrome is attractive, fast and has some impressive new features."[250]

Initially, Microsoft reportedly played down the threat from Chrome and predicted that most people would embrace Internet Explorer 8. Opera Software said that "Chrome will strengthen the Web as the biggest application platform in the world".[251] But by February 25, 2010, *BusinessWeek* had reported that "For the first time in years, energy and resources are being poured into browsers, the ubiquitous programs for accessing content on the Web. Credit for this trend – a boon to consumers – goes to two parties. The first is Google, whose big plans for the Chrome browser have shaken Microsoft out of its competitive torpor and forced the software giant to pay fresh attention to its own browser, Internet Explorer. Microsoft all but ceased efforts to enhance IE after it triumphed in the last browser war, sending Netscape to its doom. Now it's back in gear."[252] Mozilla said that Chrome's introduction into the web browser market comes as "no real surprise", that "Chrome is not aimed at competing with Firefox", and furthermore that it would not affect Google's revenue relationship with Mozilla.[253][254]

> Chrome's design bridges the gap between desktop and so-called "cloud computing." At the touch of a button, Chrome lets you make a desktop, Start menu, or QuickLaunch shortcut to any Web page or Web application, blurring the line between what's online and what's inside your PC. For example, I created a desktop shortcut for Google Maps. When you create a shortcut for a Web application, Chrome strips away all of the toolbars and tabs from the window, leaving you with something that feels much more like a desktop application than like a Web application or page.
>
> — *PC World*[255]

Usage

Market share

Chrome overtook Firefox in November 2011, in worldwide usage. As of June 2016, according to StatCounter, Google Chrome had 62% worldwide desktop usage share, making it the most widely used web browser, while Firefox had 16% and Internet Explorer had 12%.[259][260]

Along with Safari and Mozilla Firefox, Chrome receives a weekend "bump", which boosts its market share by as much as three percentage points on week-ends, at the expense of Internet Explorer.[261]

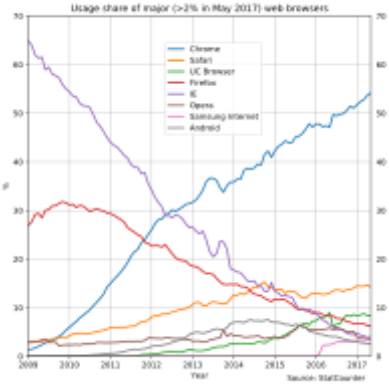
It was reported by StatCounter, a web analytics company, that for the single day of Sunday, March 18, 2012, Chrome was the most used web browser in the world for the first time. Chrome secured 32.7% of the global web browsing on that day, while Internet Explorer followed closely behind with 32.5%.[262]

From May 14–21, 2012, Google Chrome was for the first time responsible for more Internet traffic than Microsoft's Internet Explorer, which long had held its spot as the most used web browser in the world.[263] According to StatCounter, 31.88% of web traffic was generated by Chrome for a sustained period of one week and 31.47% by Internet Explorer. Though Chrome had topped Internet Explorer for single day's usage in the past, this was the first time it had led for one full week.[264]

At the 2012 Google I/O developers' conference, Google claimed that there were 310 million active users of Chrome, almost double the number in 2011, which was stated as 160 million active users.[265]

In June 2013, according to StatCounter, Chrome overtook Internet Explorer for the first time in the US.[266]

In August 2013, Chrome was used by 43% of internet users worldwide. This study was done by Statista, which also noted that in North America, 36% of people use Chrome, the lowest in the world.[267]



Usage share of web browsers according to StatCounter[256]

Browser Market Share Worldwide July 2017 (for map),[257] rank/share in December 2018[258]

- Google Chrome (62.4%)
- Safari (14.56%)
- Firefox (5.1%)
- UC Browser (4.17%)
- Opera (3.13%)

Desktop/laptop browser statistics	
Google Chrome	70.88%
Mozilla Firefox	9.5%
Internet Explorer	5.74%
Safari	5.15%
Microsoft Edge	4.41%
Others	4.33%

Desktop web browser market share according to StatCounter for January 2019.[268]

As of February 2018, Chrome is the most used browser in virtually all countries, with most exceptions in Africa.[269]

Enterprise deployment

In December 2010, Google announced that to make it easier for businesses to use Chrome they would provide an official Chrome MSI package. For business use it is helpful to have full-fledged MSI packages that can be customized via transform files (.mst) – but the MSI provided with Chrome is only a very limited MSI wrapper fitted around the normal installer, and many businesses find that this arrangement does not meet their needs.[270] The normal downloaded Chrome installer puts the browser in the user's local app data directory and provides invisible background updates, but the MSI package will allow installation at the system level, providing system administrators control over the update process[271] – it was formerly possible only when Chrome was installed using Google Pack. Google also created group policy objects to fine tune the behavior of Chrome in the business environment, for example by setting automatic updates interval, disabling auto-updates, and configuring a home page.[272] Until version 24 the software is known not to be ready for enterprise deployments with roaming profiles or Terminal Server/Citrix environments.[273]

Chromium

In September 2008, Google released a large portion of Chrome's source code as an open-source project called Chromium. This move enabled third-party developers to study the underlying source code and to help port the browser to the macOS and Linux operating systems. The Google-authored portion of Chromium is released under the permissive BSD license.[274] Other portions of the source code are subject to a variety of open-source licenses.[275] Chromium is similar to Chrome, but lacks built-in automatic updates and built-in Flash player, as well as Google branding and has a blue-colored logo instead of the multicolored Google logo.[276][277] Chromium does not implement user RLZ tracking.[107][102][278] Initially, the Google Chrome PDF viewer, PDFium, was excluded from Chromium, but was later made open-source in May 2014.[279][280] PDFium can be used to fill PDF forms.[281]

Developing for Chrome

It is possible to develop applications, extensions, and themes for Chrome. They are zipped in a .crx file and contain a manifest file that specifies basic information (such as version, name, description, privileges, etc.), and other files for the user interface (icons, popups, etc.). Google has an official developer's guide.[282] Chrome has its own web store where users and developers can upload and download these applications and extensions.[283]

See also

- Google Apps for Work
- Google Chrome Experiments
- Browser wars
- Google Chrome Frame
- History of web browsers
- List of web browsers

Notes

1. Chrome's WebKit & Blink layout engines and its V8 JavaScript engine are each free and open-source software while its other components are each either open-source or proprietary. However, section 9 of Google Chrome's Terms of Service (https://www.google.com/intl/en/chrome/browser/privacy/eula_text.html) designates the whole package as proprietary freeware.
2. RLZ can be disabled in the Chrome Operating System, and is not in Chrome browsers downloaded to a desktop directly from Google.com/chrome; no way to disable in phones, tablets, maybe laptops

3. Requires advanced user intervention

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